Identifying areas of risk for collisions between vessels and cetaceans in the north-east Atlantic

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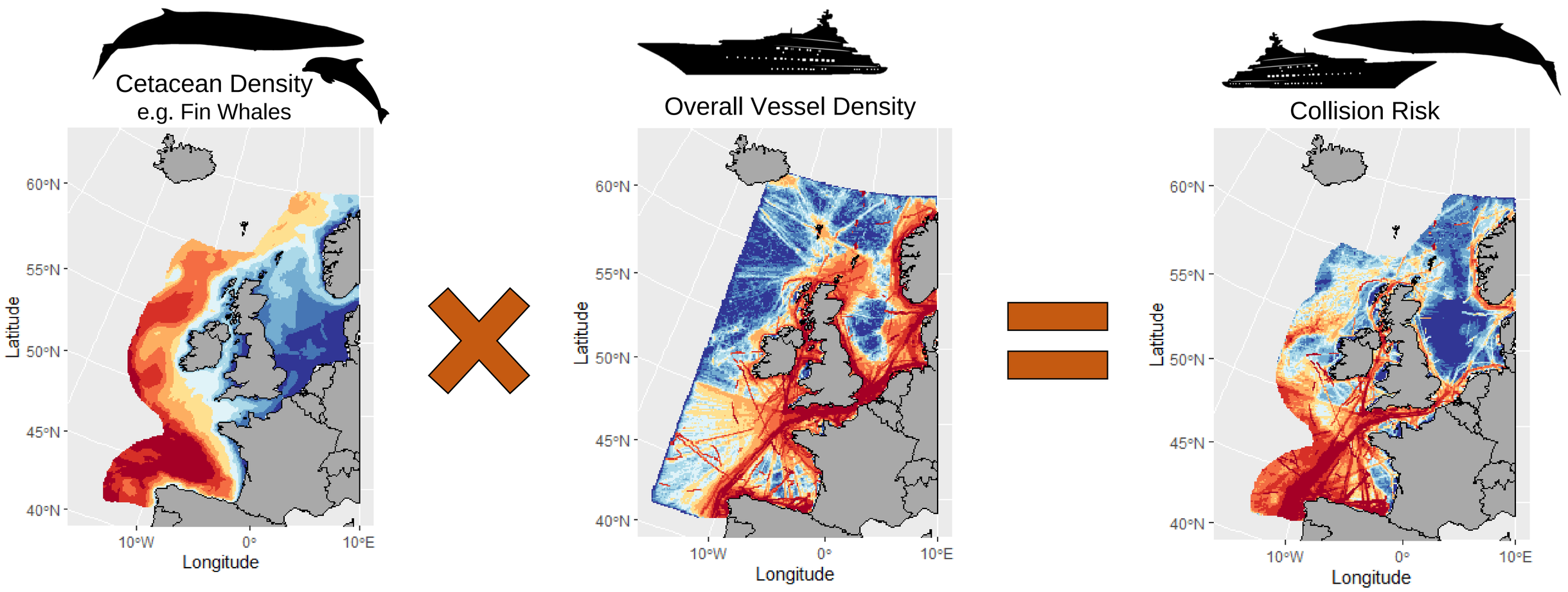
BACKGROUND

Shipping is on the increase globally[1]. Vessels collide with marine mammals but not much is known about this problem outside of certain well-studied areas where large whales are the focus[2].

We investigated the relative probability of collision risk between cetaceans and vessel traffic and highlight areas of greatest overlap.

METHODS

- Shipping density was calculated for 36 months, in 2013, 2015 and 2017.
- Relative probability of overlap between vessels and published cetacean distributions[3] was estimated for each month, vessel type, and twelve cetacean species.
- Generalized Additive Models with cyclic cubic spline for month, and smoothed influence of depth, distance to coast and ports, and longitude and latitude.



PRELIMINARY RESULTS

- Risk varies by species, month and vessel types

Collision risk is greater for cetaceans overall:

- In winter and spring
- Near to ports
- Both in inshore (<50km distance) and offshore (>250km)
- Easterly longitudes
- Middle latitudes (peak ~ 52 N)

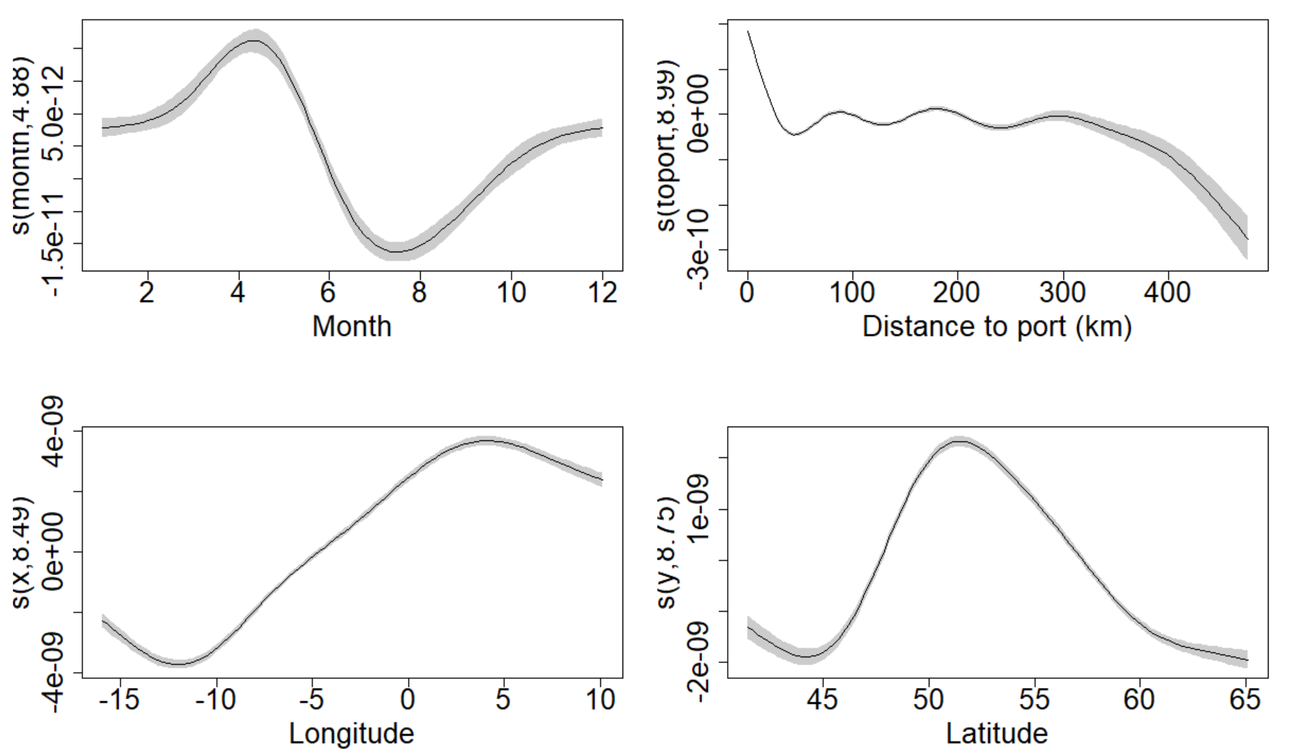


Figure: Smoothed relationship between collision risk for all studied cetaceans in the North-East Atlantic, and selected subset of model covariates, 1) Month, 2) Distance to port, 3) Longitude, and 4) Latitude.

WHAT DOES THIS MEAN?

- Collision risk is likely highest close to ports in winter months, in areas well documented to have high densities of vessel traffic.
- Visibility is often worse in winter months, and therefore vessels are less likely to see and avoid animals that they cross paths with – further increasing risk.

NEXT STEPS

- Investigate influences of risk for twelve species, across 36 months and 10 vessel types.
- Calculate probability of mortality[4]
- Synthesize results to suggest mitigation measures.

References:
[1] Sardain, A., Sardain, E., & Leung, B. (2019). Global forecasts of shipping traffic and biological invasions to 2050. *Nature Sustainability*, *2*(4), 274–282.
[2] Schoeman, R. P., Patterson-Abrolat, C., & Plön, S. (2020). A Global Review of Vessel Collisions With Marine Animals. *Frontiers in Marine Science*, *7*, 292.
[3] Waggitt, J. J., Evans, P. G. H., Andrade, J., Banks, A. N., Boisseau, O., Bolton, M., Bradbury, G., Brereton, T., Camphuysen, C. J., Durinck, J., Felce, T., Fijn, R. C., Garcia-Baron, I., Garthe, S., Geelhoed, S. C. V., Gilles, A., Goodall, M., Haelters, J., Hamilton, S., … Hiddink, J. G. (2019). Distribution maps of cetacean and seabird populations in the North-East Atlantic. *The Journal of Applied Ecology*, *8*, 1. https://doi.org/10.1111/1365-2664.13525
[4] Vanderlaan, A. S., & Taggart, C. T. (2007). Vessel collisions with whales: the probability of lethal injury based on vessel speed. *Marine mammal science*, *23*(1), 144-156.

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